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## Bulletin No. 179 - Apple Candy: A Commercial Use for Cull Apples

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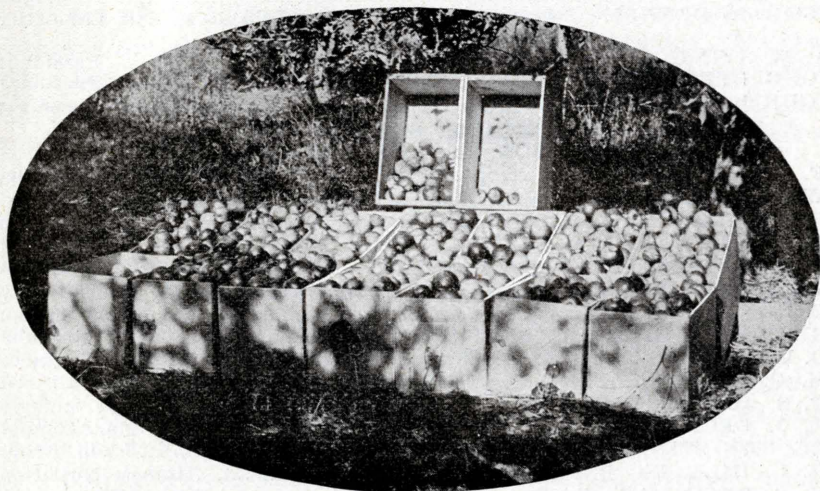
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# APPLE CANDY

## A Commercial Use for Cull Apples

By  
T. H. ABELL



BULLETIN NO. 179

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Utah Agricultural College  
**EXPERIMENT STATION**

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Logan, Utah

January 1921

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# APPLE CANDY

## A COMMERCIAL USE FOR CULL APPLES

By  
T. H. ABELL

Utah annually produces many tons of apples that never reach the consumer. These apples remain on the farm for various reasons: (1) because there are not adequate marketing facilities, (2) because the fruit is of inferior quality, (3) because orchard units are too small for buyers to consider, and (4) because home orchards are so large that the crop cannot be utilized. On the other hand, apples of inferior quality go to the market alongside apples of high quality. The result is a lowering of the price of apples in general and dissatisfaction on the part of the retailer and consumer because some of the apples are inferior.

The ideal method for disposal of apples grown in Utah would seem to be the practice, as followed in other states, of dividing the fruit into three classes: (1) first-class, typical, sound fruit to be disposed of as dessert apples; (2) inferior, small, misshapen but sound fruit to be utilized as dried stock, jams, jellies, cider, etc., and (3) all wormy fruit to be fed to livestock.

It is not necessary to have a large percentage of wormy apples. Modern methods of spraying make it possible for anyone to reduce the wormy fruit to below 5 per cent of the crop. If every apple tree in the state were consistently sprayed every year, the worm crop could be reduced to below 1 per cent. Furthermore, wormy apples should never be used for human consumption, particularly not for cider and vinegar.

Apple trees that are carefully pruned, sprayed, irrigated, cultivated, and thinned will produce a high percentage of standard-sized, properly colored, sound fruit which if carefully handled, graded, and packed will bring top prices as dessert apples.

There will always be a large quantity of sound but small, misshapen, and blemished apples which if sold with the first-class fruit will lower the standard of the whole, bring a lower price for the best fruit, and create dissatisfaction all along the line. The logical method of disposing of this class of fruit is in the form of by-products. But the fruit by-products industry in Utah has not been developed to the extent that is possible or probable.

Realizing this need for the development of an industry that would relieve the fruit growers of Utah of the necessity of selling their second-rate fruit in the same market with their best fruit

or of feeding it to the hogs, the Department of Horticulture initiated, in 1917, a project for the investigation of processes that would be likely to encourage the fruit by-products industry in this state. The first definite result obtained is the discovery of the possibility of the use, on a large scale, of second-rate apples as a candy.

The process of manufacture is not startlingly new; it is simply the application of a few age-old principles for the production of a modern article. Apple candy is a new and economical form of apple paste.

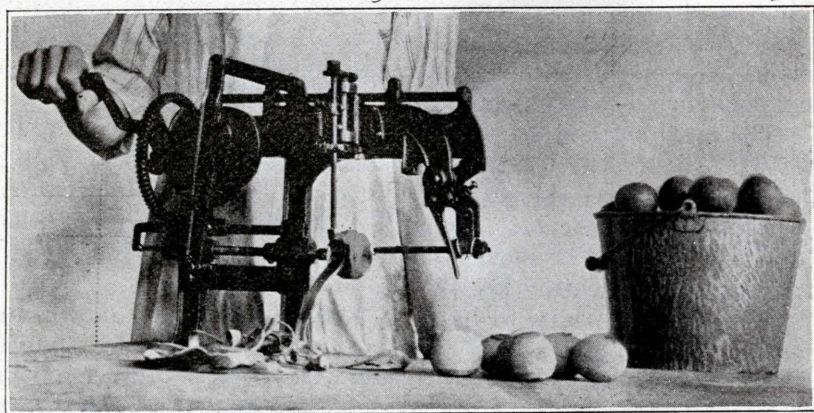


Fig. 1.—Peeling and Coring the Apples.

#### HISTORICAL

Fruit pastes have been a common form for preserving fruits in tropical and Old World countries for many years. These fruit pastes have been used much as we use candy and also in combination with cheese as a salad at meal time. In fact, in the southern states cheese and fruit pastes are widely used as a salad<sup>1</sup>.

High grade pastes are made from apples, apricots, cherries, gooseberries, grapes, guavas, kumquats, pears, plums, quinces, and many other fruits as well as vegetables. The fruit pulp is separated from the seeds, cores, skin, etc., placed in a flat container with a large quantity of sugar, corn syrup, or other sweetening, and cooked slowly with frequent stirring until quite

<sup>1</sup>Creswell and Powell—"Home Canning of Fruits and Vegetables," U. S. D. A. Farmers' Bulletin 853 (1917), and Dearing—"Muscadine Grape Paste," U. S. D. A. Farmers' Bulletin 1053 (1919).



stiff. The paste is then poured out to a depth of one-half inch on a greased smooth surface, such as marble, porcelain, or enamel, and allowed to cool and dry for several days. When nearly dry the paste is cut into desired shapes, rolled in powdered or granulated sugar and dried some more. It is then stored in air-tight containers. When carefully made, and especially when several fruits are blended, these fruit pastes are a delicious and wholesome confection.

These fruit pastes should find a ready market if they could be manufactured on a large scale. However, the process required to cool and dry the fruit pastes practically prohibits economical manufacture. Hence the desirability of finding new ways and means to utilize fruit pastes, as described in this bulletin.

For many years the French have been experts at making delicate confections called "fruits confits" and "fruits glaces." "The former are fruits which retain their natural form and color and have absorbed quantities of sugar; the latter only differ from the former in that they have been redipped and given a crystalline coating of sugar, so that they are dry to the touch and agreeable to handle<sup>1</sup>." These delicacies may be procured at many confectioneries in America, but owing to the great cost of manufacture are very expensive and therefore not within the reach of the majority of candy consumers. Furthermore, this process can utilize only crabs and very small varieties of apples; ordinary apples are not adaptable. These facts then eliminate "fruits confits" as a possible form for utilizing any large quantities of apples.

James<sup>2</sup>, while attempting to work out a concentrated form of apple for the use of the soldiers in the trenches in the late World War, discovered a product that he recommends for use as candy. He calls it "apple flakes." "Apple flakes" are made by first removing the apple skin and then paring the entire apple down to the core into long, thin strips, mixing with granulated sugar and drying in an air blast. The advantages claimed for this method are: (1) the elimination of coring and slicing; (2) the elimination of sulfuring because the sugar helped to retain the light color of the fruit; (3) the high quality and palatability of the product.

Thus, "apple flakes" are the first candy-like form which promised the possibility of utilizing large quantities of apples, and that could be made available to the general public.

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(1) Dept. of Commerce and Labor, Bur. of Manuf. Monthly Consular and Trade Reports, (April 1909), No. 343, pp. 111-121.

(2) James, W. P.—"Apple Flakes" Ill. Agr. Exp. Sta. Cir. 213. (1918).

## THE DESIRABILITY OF FRUIT CANDIES

This is truly a "candy age." A person needs only to be observant to see that every candy kitchen and candy store is thriving. The candy business is growing rapidly and is assuming the importance of such stable industries as transportation, mining, and manufacturing. In fact, candy-company stocks are eagerly sought by investors.

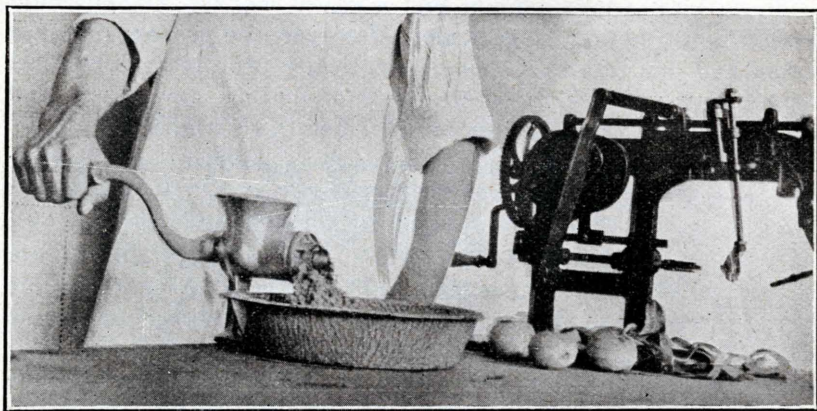


Fig. 2 —Grinding the Apples thru a Household Food Chopper.

Data secured from the National Confectioners' Association of the United States show the following advances in the candy industry from 1849 to 1919: From very few candy factories to probably 3,000, about 300 of which were established in 1919; from about 3,000 retailers to approximately 75,000. In 1918 the capital invested in the manufacturing end of the business was in the neighborhood of \$160,000,000. There were 75,000 employees engaged in candy-making, and they manufactured 1,400,000,000 pounds of candy which sold to the consumer for \$700,000,000. Of the total 4,000,000 tons of sugar consumed in the United States in 1918 about 350,000 tons were used in candy. This business is truly immense.

Among the causes of the recent rapid growth of the candy industry may be mentioned the coming of prohibition, increased earnings and thus a seeking for luxuries on the part of formerly poor people, candy habit formed by soldiers in training, and the discovery of the high food value of candy.

With this increased demand for candy there is sure to be more or less cheap candy made with a doubtful effect on the health of the consumer. On the other hand, there is danger of



over-eating of the best candies which are high in sugar content. Fruit candies, which would be as palatable and valuable as sugar candies, are also valuable for their acids, fruit esters, and fruit sugars, and therefore would be healthful, especially as an aid to digestion.

With these things in mind, and since the apple is the biggest fruit crop in this country, there seems to be no valid reason why an apple candy should not be developed to take its place beside the fruit candies that now exist.

#### APPARATUS AND MATERIALS

The experiments hereinafter described were performed with the following apparatus and materials:

The fruit was evaporated in a small tunnel-type evaporator built after the plans given in Oregon Extension Circular No. 213. Both coal and wood were used as fuel and the temperature in the evaporator ranged from 90° to 120° F.

The apples were peeled and cored with an Improved '98 Bonanza Apple Parer and Corer (Fig. 1). The grinding was done with an ordinary household food chopper (Fig. 2). Dipping and steaming baskets were made of pearl screen wire and the steaming was done in a galvanized wash boiler over a gas flame (Fig. 5).

Twelve varieties of apples were used: Antonovski, Black Twig, Gano, Gravenstein, Grimes, Jeniton, Jonathan, Lawver, McAfee, Northwestern Greening, Rhode Island Greening, and Rome.

#### EXPERIMENT I

**Method.**—The first method to be tried out was that originated by James—the “apple flake” method described above. This method was given a thorough test with several varieties of apples under conditions as ideal as they could be made with the apparatus available.

**Results.**—These trials showed the following results:

(1) The high quality and palatability of “apple flakes” is all that is claimed for them.

(2) The sugar in amounts up to 25 per cent did not appreciably prevent darkening of the tissues of the apples. This, however, is probably not of great importance from the standpoint of a candy product.

(3) The flakes acquire a “hay-lake” flavor after several months in either ventilated or air-tight storage.



(4) The cost of preparing this product is so great as to make commercial manufacture prohibitive. The labor was the larger and more prohibitive item.

(5) Only a good grade of apples may be used since apples which have become slightly soft would not stay on the machine during the paring process.

In spite of the drawbacks the product was of such striking palatability that it was determined to attempt, if possible, to improve the method and reduce the cost of manufacture. This, then, was the primary object of Experiment II.

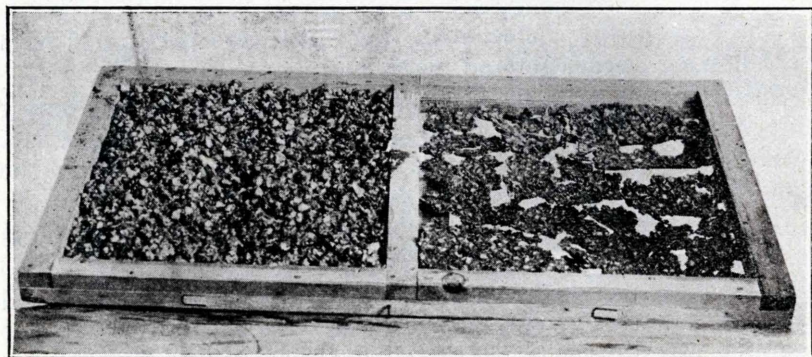


Fig. 3.—Apple Leather on Drying Tray. Left: Before Drying. Right: Leather Dried.

## EXPERIMENT II

**Method.**—In the search for a quicker and cheaper method of breaking up the apples into a desirable shape for drying, dicing and ricing machines were tried, but with poor results. Finally, it was found that an ordinary household food chopper, such as is used for chopping up apples for mincemeat, worked up the apples more easily and in about one-third to one-fourth the time required by the “apple flake” method. These chopped apples were then mixed with granulated sugar and spread on the drying trays.

After several trials with various amounts of sugar it was determined that fifteen pounds of sugar were required for every one hundred pounds of chopped apples. Less sugar produced a flavor not sweet enough, more sugar drew the juice from the tissues of the apples and caused a loss by excessive dripping.

Thus treated, the apples were evaporated in the tunnel evaporator.

**Results.**—This experiment showed that a quicker and cheaper

method for preparing apples for candy was to peel, core, and trim, grind through a food chopper as for mincemeat, mix with sugar (15 pounds to 100 pounds of apples) and dry for 36 to 48 hours. The result is a fairly sweet "apple leather" having the appearance of peanut brittle. (Fig. 3).

### EXPERIMENT III

**Object.**—The "apple leather" secured in Experiment II was too tough to be easily chewed; furthermore, it was not sweet enough. The object of this experiment was to find some method for softening and further sweetening the product.

**Method.**—Noting that the Europeans secure a soft and sweet candied product by immersing the fresh fruit in concentrated syrups, it was assumed that some variation of this process would give the desired results in this case. The leather was broken up by hand into small pieces, placed in a wire basket, immersed for various intervals in boiling sugar solutions, and spread out on trays to dry. Various concentrations of sugar were used.

**Results.**—It was found that by immersing the leather for one minute in a boiling syrup composed of one pound of sugar and one pint of water a soft, sweet, sugar-coated product was secured. This candy product was ideal in every way except that the pieces were so large and stiff that the mass could not be easily worked into desirable shapes. The method of production was also objectionable in that the labor required to break up the leather, the second drying process, and the waste of sugar in the sweetening process added too much to the cost of the product.

### EXPERIMENT IV

**Object.**—The object of this experiment was to find a better method of softening and sweetening the "apple leather." This method must be economical of labor, not wasteful of sugar, and must turn out the candy in a finely divided, pliable form.

**Method.**—Since the common food chopper gave such excellent results in breaking up the fresh apples, it was given a trial in grinding up the "apple leather." This turned out the "leather" in a fine, paste-like, pliable form. This, however, was not cohesive enough to be readily molded into desirable shapes. This cohesive property was supplied by placing the paste in wire baskets which were placed in a steam vat contrived from a gas burner and wash boiler. The time of steaming varied from 10 to 20 minutes, depending on the former water content of the paste and the depth of the mass in the basket.



The apple paste or candy now possessed every desirable quality except sweetness. This was obtained by stirring granulated sugar into the freshly steamed mass.

**Result.**—The resulting product was better than anything that had been produced in any of the other experiments. However, there were still two objections to it. The steaming made the apples very dark—nearly black—and the granulated sugar gave it an objectionable “gritty” feeling when taken into the mouth.

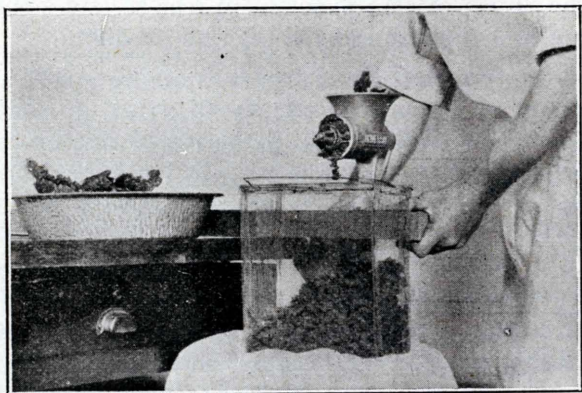


Fig. 4.—Apple Leather Being Ground into Dry Paste.

#### EXPERIMENT V

**Object.**—The object of this experiment was to overcome the objectionable features of the product described above.

**Method.**—After several trials it was found that a syrup composed of three pounds of sugar and one quart of water, stirred into four pounds of the dry ground leather, produced a soft, sweet, pliable paste that is an excellent confection. Chopped nuts and cocoanut were added for variety.

**Results.**—This method required about one-third the labor used in Experiment III and so was economical in that respect. Furthermore, there was no waste of sugar as in the dipping method. The final product is a palatable soft candy that may be easily molded into any desirable form.

#### OUTLINE OF PERFECTED PROCESS

1. Apples washed, peeled, cored, and trimmed.
2. Ground up in food chopper and weighed.
3. Granulated sugar at rate of 15 pounds to 100 pounds of chopped apples thoroughly stirred in.

4. Spread one-half inch deep on drying trays and evaporated for 36 to 48 hours. This dried mass is called "apple leather" and it may be stored indefinitely.

5. "Apple leather" is ground up in food chopper and so becomes a dry paste-like substance. (Fig. 4). This is also a storage form, and is called "apple paste."

6. A syrup composed of three pounds of sugar and one quart of water is made. This is stirred into four pounds of dry paste. Nuts and cocoanut may also be added.

7. The result is apple candy which may be molded into any desirable form and then allowed to harden slightly before use.

8. The peelings and cores should be saved as they may be easily cooked up for jelly. In commercial manufacture this would help to pay the cost of operating the plant.

#### SUITABILITY OF DIFFERENT VARIETIES

The work was begun with twelve varieties of apples, but since only small quantities of several varieties were available complete data were secured for only six: Antonovski, Black Twig, Grimes, Jonathan, Northwestern Greening, and Rome.

Grimes and Jonathan made up into light golden-brown paste, while the other varieties made up into darker paste. However, the color of the paste is not so important as the flavor.

Samples of the paste of all six varieties were tested for flavor by three persons working independently. They were to make a choice of the two best samples. All three persons selected different varieties for the best, and their judgment of flavor was quite varied. Antonovski, Grimes, Jonathan, and Rome were selected as the best. However, all agreed that there was not enough difference between the varieties to warrant

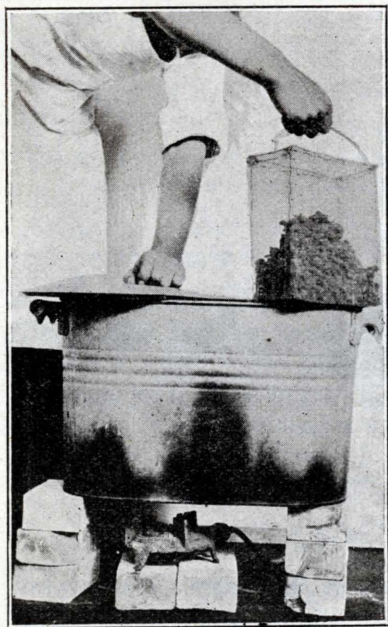


Fig. 5.—Placing the dry paste in the steam vat.

a decision that any were unfit for use in making apple candy. This indicates that probably most any variety of apple may be used in the process.



## COST OF PRODUCTION STUDIES

In order to determine the items in the cost of producing apple candy careful record was kept of the materials used and time consumed to perform all operations.

On account of the small size of the evaporator used no attempt was made to determine the fuel cost of drying. From questionnaires sent to many commercial evaporators in California, Oregon, and Washington, it was learned that their fuel cost ranged from one-half cent per pound of dried apples, using oil burners, to two cents per pound of dried apples, using wood furnaces. The cost would probably be about two cents also for coal.

The following is a summary of the items in the cost of producing one pound of apple paste:

*Table I. Items of Cost of Producing 1 Pound of Apple Paste*

Variety	No. of Trials	Pounds of Whole Apples (fresh weight)	Ounces of Sugar	Minutes of Labor
Black Twig.....	10	4.4	8.1	21.3
Antonovski.....	3	3.6	7.3	14.3
Grimes.....	21	4.2	7.1	20.3
Jonathan.....	12	4.2	7.2	21.3
N. W. Greening.....	5	4.3	7.3	24.3
Rome.....	22	4.1	7.5	19.3
Average of 73 Trials		4.1	7.4	20.3

No prices are given because prices of both materials and labor are so variable that any prices given here would probably have no value in future times or other places.

All of the work was performed by hand and materials were used in small lots. By working with larger units and up-to-date power machinery the labor cost could possibly be cut to one-half or one-third the amount required with hand methods.

## HOME MANUFACTURE

Apple candy may be easily made in the home. On account of its pure and wholesome contents, apples and sugar, apple candy is especially attractive as a kitchen product in a home where there are children. The ordinary kitchen is equipped with all the utensils necessary for the process.

The apples may be peeled by hand or with a small hand machine and cored with a hand corer or knife. The small home food chopper is just the thing for breaking up the fresh apples

and later the apple leather. Small spring scales are sufficiently accurate for weighing the apples and sugar. The apples may be dried in the oven, stove drier, or any other device that drives out the moisture without burning.

The final product molded into fantastic shapes will be a source of pleasure for the "kiddies" that consume it.

#### COMMERCIAL ADAPTATION

By the addition of a little more machinery, dried-apple paste could be manufactured commercially in any evaporating plant in which the drying is done on trays.

The apples may be peeled and cored on the power machines and trimmed by hand as usual. Instead of being sliced they may then be put through a power chopper or cutter such as is used in preparing apples for mince-meat. The apples may then be mixed in a power mixer with the required amount of sugar and spread on the trays to dry. When dry, the leather may be immediately ground up into "paste" and stored, or stored in the "leather" form and ground up later as it is sold.

It would be desirable for the evaporators to sell the product in the dry "paste" form. The candy manufacturer could then mix in the syrup in small quantities as it is needed. This would also save transportation charges on sugar and water.

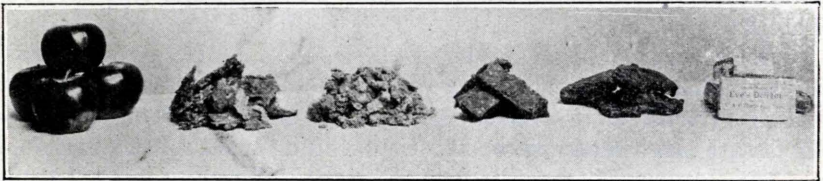


Fig. 6.—The Evolution of the Apple.—From left to right the exhibits are: fresh apples, apple leather, dry apple-paste, bars formed from sugared paste, bars chocolate dipped, bars wrapped and labeled for sale.

#### A TEST OF ITS SALABILITY

The question naturally arises: "Will the public buy confections made of apple candy?" In order to answer this question the Department of Horticulture made the candy up into chocolate-coated bars and offered it for sale at a candy counter which makes a specialty of candy bars. (Fig. 6). These apple candy bars sold quite readily and in constantly increasing quantities during the



five months of the test, and this without any advertisement to swing local curiosity in their favor.

#### SUMMARY

1. There is a need for the fruit by-products industry to be developed in Utah. The Department of Horticulture of the Utah Experiment Station has initiated an experimental project along this line.

2. The results of this experimental work to date show that large quantities of small, blemished, misshapen, worm-free apples could be utilized in the form of apple candy.

3. This apple candy is the most economical form evolved up to the present time.

4. Apple candy is highly palatable, pure, wholesome, and desirable for candy-loving children.

5. The process of manufacture is simple.

6. Apple candy may be easily made in the home.

7. Apple candy is adaptable to commercial manufacture. All of the operations may be performed by unskilled labor.

8. It has been demonstrated that the public will buy apple candy.

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